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Puerto Rico Agricultural Experiment Station
of the
United States Department of Agriculture

SEP 14 '84
AGRICULTURAL NOTES

No. 69 PAGE I

MAYAGUEZ, P. R.

APRIL 15, 1936

NOTES ON THE PRESENT SUGARCANE-DISEASE SITUATION IN PUERTO RICO

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SURVEYS AID IN GUARDING AGAINST NEW DISEASES:

WITHIN THE LAST 20 YEARS SUGARCANE GROWERS OF PUERTO RICO HAVE PASSED THROUGH AN EPIDEMIC OF SUGARCANE MOSAIC AND HAVE BEEN ALARMED BY SCATTERED OUTBREAKS OF GUMMOSIS AND EYE-SPOT DISEASES. FORTUNATELY, THROUGH THE CHANGE OF CANE VARIETIES OR THE INSTIGATION OF ROGUEING PROGRAMS, EACH DISEASE HAS BEEN IN TIME MORE OR LESS BROUGHT UNDER CONTROL.

A SURVEY OF THE PRESENT SUGARCANE-DISEASE SITUATION HAS RECENTLY BEEN COMPLETED BY THE PUERTO RICO EXPERIMENT STATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE, UNDERTAKEN AT THE SUGGESTION OF DR. E. W. BRANDES, IN CHARGE OF THE DIVISION OF SUGAR PLANT INVESTIGATIONS OF THE BUREAU OF PLANT INDUSTRY. THE PRIMARY PURPOSE OF THIS SURVEY WAS TO DETERMINE THE MAJOR DISEASES AND AGRICULTURAL PROBLEMS CONFRONTING THE VARIOUS SUGARCANE GROWERS. AN EQUALLY IMPORTANT OBJECTIVE WAS TO DETERMINE BY CAREFUL EXAMINATION OF REPRESENTATIVE AREAS WHETHER OR NOT ANY NEW DISEASES WERE GAINING FOOTHOLD IN THIS ISLAND. THE PURPOSE OF THIS REPORT IS TO PRESENT INTERESTING NEW DEVELOPMENTS IN OUR KNOWLEDGE OF SUGARCANE-MOSAIC VIRUS AND GENERAL NOTES ON THE SUGARCANE-DISEASE SITUATION AS FOUND IN PUERTO RICO AT THE PRESENT TIME.

SUGARCANE MOSAIC

MOSAIC OCCURS IN ALL PARTS OF PUERTO RICO BUT LESS ALONG THE SOUTH COAST:

SUGARCANE MOSAIC HAS BEEN KNOWN SINCE ABOUT 1919 TO OCCUR IN ALL PARTS OF

PUERTO RICO. WHILE THE AMOUNT OF DISEASED PLANTS WAS FOUND TO VARY IN SOME LOCAL AREAS, CONSIDERABLE INFECTION WAS FOUND IN ALL PORTIONS OF THE ISLAND. ALTHOUGH IT HAS BEEN KNOWN FOR A NUMBER OF YEARS THAT A LOWER PERCENTAGE OF INFECTION OCCURS IN THE MORE ARID REGION ALONG THE SOUTH COAST, NO EXPLANATION FOR THIS UNEVEN DISTRIBUTION HAS AS YET BEEN DEFINITELY ESTABLISHED.

AT THE PRESENT TIME THE AMOUNT OF INFECTION IN INDIVIDUAL FIELDS THROUGHOUT THE ISLAND VARIES FROM NONE OR ALMOST NONE IN FIELDS WHERE HIGHLY RESISTANT VARIETIES OR CAREFUL CONTROL MEASURES ARE IN USE TO NEARLY 100 PERCENT IN THE CASE OF FIELDS OF SUSCEPTIBLE VARIETIES WHERE NO CONTROL MEASURES HAVE BEEN USED.

RESISTANT VARIETIES OR ROGUEING COMPLETELY CONTROL MOSAIC:

THE CONTROL OF SUGARCANE MOSAIC IS HANDLED IN A NUMBER OF WAYS. SOME GROWERS WERE FOUND TO EXERCISE CONSIDERABLE CARE IN THE CONTROL OF THIS DISEASE EITHER BY THE PERIODIC REMOVAL OF DISEASED PLANTS OR BY THE USE OF RESISTANT VARIETIES. OTHER GROWERS SEEMED TO PAY LITTLE ATTENTION TO THE DISEASE, AND AS A CONSEQUENCE THE FIELDS PLANTED TO SUSCEPTIBLE VARIETIES WERE USUALLY FOUND TO BE ALMOST ENTIRELY DISEASED. WHILE THE LOSSES IN YIELDS DUE TO SUGARCANE MOSAIC NO DOUBT VARY WITH CONDITIONS OF GROWTH AND VARIETY, ALL EXPERIMENTAL EVIDENCE POINTS TO THE CONCLUSION THAT A HIGH INCIDENCE OF MOSAIC BRINGS ABOUT A CONSIDERABLE REDUCTION IN TONNAGE OF CANE AND SUGAR PER ACRE.

THE RESISTANT VARIETIES P.O.J. 2878, MAYAGUEZ 28, P.R. 803, AND P.R. 807 ARE NOW PLANTED IN CONSIDERABLE ACREAGES. IN OTHER AREAS WHERE PLANTING OF SUSCEPTIBLE VARIETIES SUCH AS B.H. 10(12) APPEARS TO BE MORE PROFITABLE, THE COST OF ROGUEING IN A WELL-CONDUCTED AGRICULTURAL PROGRAM CAN BE HELD DOWN TO A REASONABLY SMALL AMOUNT. THE INITIAL COST IN REMOVING DISEASED PLANTS FROM FIELDS SHOWING HIGH INCIDENCE OF INFECTION IS, OF COURSE, CONSIDERABLE. HOWEVER, AT SEVERAL CENTRALS IT HAS BEEN FOUND THAT THE COST OF CARRYING OUT AN AGGRESSIVE ROGUEING PROGRAM OVER A PERIOD OF YEARS IS NOT EXCESSIVE. SOME GROWERS WHO HAVE PURSUED THE POLICY OF PERIODICALLY REMOVING DISEASED PLANTS FIND THAT AN INSPECTION AND SUBSEQUENT REMOVAL OF DISEASED PLANTS CAN

BE MADE AT A COST AS LOW AS SIX TO TEN CENTS PER ACRE. CONSIDERING THAT THREE TO FOUR SUCH INSPECTIONS ARE ORDINARILY REQUIRED YEARLY, THE COST PER ACRE, THEREFORE, CAN BE HELD AS LOW AS TWENTY-FIVE TO FORTY CENTS PER CROP. IN SUSCEPTIBLE VARIETIES SUCH DISEASE-CONTROL COSTS SHOULD SHOW A CONSIDERABLE MARGIN OF PROFIT OVER LOSSES TO BE EXPECTED FROM UNCONTROLLED MOSAIC DISEASE.

INFECTION IN YOUNG FIELDS NEAR HILLS MUCH HIGHER THAN NEAR SEA:

ONE OF THE INTERESTING POINTS WHICH HAS BEEN FOUND BEFORE BY OTHER OBSERVERS AND IS AGAIN BROUGHT OUT IN THIS SURVEY IS THE DISTRIBUTION OF NEW MOSAIC INFECTION IN YOUNG FIELDS. ALMOST WITHOUT EXCEPTION GROWERS REPORT THAT SOME THREE TO TEN TIMES AS MUCH INFECTION OCCURS IN YOUNG FIELDS PLANTED NEAR THE HILLS AND PASTURE LANDS AS IN YOUNG FIELDS PLANTED AT THE SAME TIME NEAR THE SEA OR IN THE MIDST OF MOSAIC-FREE FIELDS. ALTHOUGH SEVERAL THEORIES HAVE BEEN ADVANCED PREVIOUSLY FOR THIS UNEVEN DISTRIBUTION OF NEW INFECTION, NO DEFINITE AND CLEAR-CUT EXPLANATION HAS AS YET BEEN ESTABLISHED. THERE IS SOME FIELD EVIDENCE INDICATING THAT THERE MAY BE A RELATIONSHIP BETWEEN THE LOCATION OF THE FIELDS AND THE NATURAL HOST PLANTS OF THE INSECT VECTOR, APHIS MAIDIS. SOME FIELD EVIDENCE INDICATES ALSO THAT A RELATIONSHIP EXISTS BETWEEN THE PROXIMITY TO NATIVE HOST PLANTS SERVING AS RESERVOIRS FOR THE SUGARCANE-MOSAIC VIRUS AND THE INCIDENCE OF NEW INFECTION. CONTROLLED EXPERIMENTATION TESTING SOME OF THE FIELD EVIDENCE ON THESE QUESTIONS MAY POSSIBLY DEVELOP SOME NEW METHODS OF ATTACK,

EVIDENCE OBTAINED THAT TWO OR MORE STRAINS OF SUGARCANE-MOSAIC VIRUS OCCUR IN PUERTO RICO:

IT WAS NOTED EARLY IN THE SURVEY THAT THE MOTTLING PATTERNS EXHIBITED BY PLANTS DIFFER IN VARIOUS PARTS OF THE ISLAND. IN SOME INSTANCES THE PATTERNS APPEARED TO BE MORE BRILLIANTLY YELLOW IN COLOR; SOME PATTERNS WERE MORE SHARPLY OUTLINED THAN OTHERS. IN SOME CASES SYMPTOMS WERE PRESENT THROUGHOUT ALL LEAVES OF THE PLANTS, WHEREAS OTHER PATTERNS SEEMED TO BE RESTRICTED TO CERTAIN LEAVES. IN VIEW OF THE

RECENT REPORT BY SUMMERS ON THE OCCURRENCE OF SUGARCANE-MOSAIC STRAINS IN LOUISIANA, TOGETHER WITH THE FINDINGS THAT VIRUS STRAINS OCCUR IN VIRUS DISEASES OF OTHER CROP PLANTS, SPECIAL ATTENTION IN THIS SURVEY WAS DIRECTED TOWARD THE COLLECTION OF ANY EVIDENCE INDICATING THE OCCURRENCE OF MORE THAN ONE STRAIN OF SUGARCANE-MOSAIC VIRUS IN PUERTO RICO. AS A RESULT FIELD EVIDENCE HAS BEEN OBTAINED THAT TWO OR MORE STRAINS OF SUGARCANE-MOSAIC VIRUS OCCUR IN PUERTO RICO. THE OCCURRENCE OF TWO OR MORE STRAINS OF SUGARCANE-MOSAIC VIRUS IN PUERTO RICO MAY EXPLAIN THE VARIATIONS IN INCIDENCE OF INFECTION AND THE APPEARANCE OF DISEASED PLANTS FOUND IN VARIOUS SECTIONS OF THE ISLAND.

GUMMOSIS

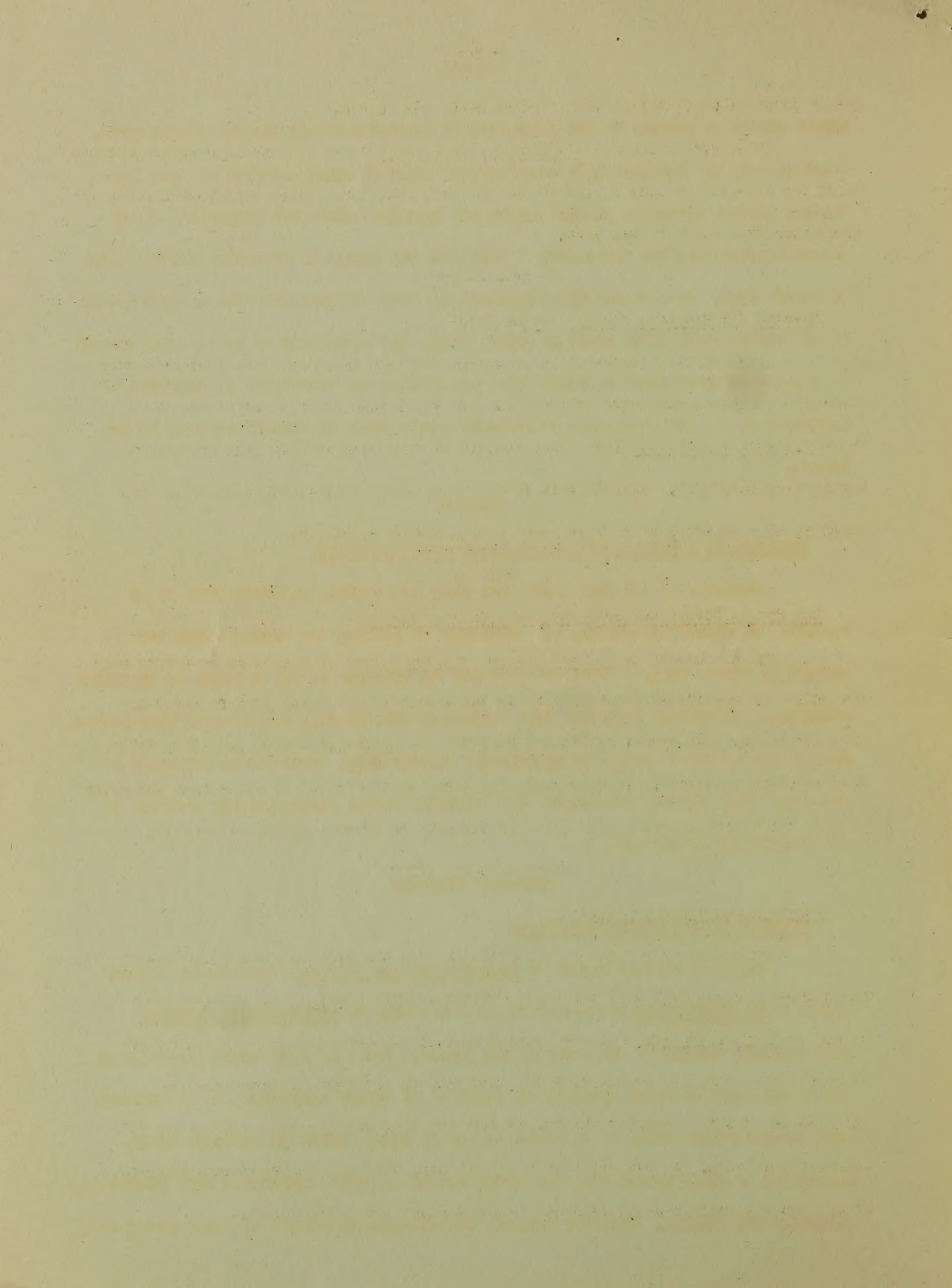
GUMMOSIS IS A SERIOUS DISEASE IN SUSCEPTIBLE VARIETIES:

GUMMOSIS AT ONE TIME CAUSED THE SUGARCANE GROWERS IN PUERTO RICO TO BE ALARMED. AT PRESENT NO LOSSES, OR PRACTICALLY NO LOSSES, ARE SUFFERED FROM THIS DISEASE IN PUERTO RICO, A CONDITION PROBABLY DUE ENTIRELY TO THE PLANTING OF RESISTANT VARIETIES. ON CERTAIN VARIETIES THIS DISEASE IS VERY SEVERE, AND IT WOULD SEEM LOGICAL THAT NO NEW VARIETIES SHOULD BE EXTENSIVELY PLANTED UNTIL PROVEN TO BE RESISTANT TO GUMMOSIS. THIS DISEASE CONSTITUTES THE PRINCIPAL FACTOR PREVENTING THE CROPPING OF THE VARIETY HAWAII 109 HERE.

LEAF-SPOT DISEASES

EYE-SPOT IS NOT SEVERE THIS YEAR:

EYE-SPOT DISEASE CAUSED BY HELMINTHOSPORIUM OCELLUM, BROWN-STRIPE DISEASE CAUSED BY H. STENOSPILUM AND RING-SPOT DISEASE CAUSED BY LEPTOSPHAERIA SACCHARI WERE OBSERVED PRESENT IN ALL PARTS OF THE ISLAND. WHILE IN SOME FIELDS OCCASIONALLY ONE OR THE OTHER OF THESE DISEASES WAS FOUND TO BE FAIRLY WIDESPREAD, IN NO INSTANCE WERE SERIOUS LOSSES FOUND TO BE CAUSED BY ANY OF THEM. THESE ARE DISEASES WHICH, ORDINARILY OF MINOR IMPORTANCE, MAY BECOME SEVERE AND VERY DESTRUCTIVE WHEN SUSCEPTIBLE VARIETIES ARE PLANTED. EYE-SPOT DISEASE, FOR EXAMPLE, IS USUALLY OF MINOR IMPORTANCE,



BUT ON SUSCEPTIBLE VARIETIES THIS DISEASE KILLS THE PLANTS.

RED-STRIPE CAUSED BY PHYTOMONAS RUDRILINEANS OCCURS IN THE MORE HUMID SECTIONS WHERE THE RAINFALL IS DISTRIBUTED THROUGHOUT THE YEAR. NO SERIOUS LOSSES WERE FOUND TO OCCUR FROM THIS DISEASE THIS YEAR.

DRY-TOP ROT

DRY-TOP ROT HAS BEEN SERIOUS IN THE PAST:

ALTHOUGH THE LITERATURE ON SUGARCANE DISEASES IN PUERTO RICO INDICATES THAT CONSIDERABLE LOSSES HAVE BEEN SUFFERED IN PAST YEARS FROM DRY-TOP ROT CAUSED BY PLASMODIOPHORA VASCULARUM, VERY SMALL AMOUNTS OF THIS DISEASE HAVE BEEN OBSERVED IN PUERTO RICO THIS YEAR. WHETHER THIS IS DUE TO CLIMATIC VARIATIONS, ABSENCE OF VERY SUSCEPTIBLE VARIETIES, OR TO SOME OTHER FACTOR CANNOT BE STATED.

RED ROT

RED ROT IS COMMON BUT DOES NOT CAUSE SERIOUS LOSSES:

RED ROT CAUSED BY COLLETOTRICHUM FALCATUM OCCURS IN ALL PARTS OF PUERTO RICO BUT UNDER OUR CONDITIONS OF GROWTH AND IN THE VARIETIES NOW GROWN IT DOES NOT CAUSE SERIOUS DAMAGE. THE AMOUNT OF RED ROT SEEMED TO BE SLIGHTLY GREATER IN P.O.J. 2878 THAN IN OTHER VARIETIES. IN MOST INSTANCES INFECTIONS APPEARED TO START FROM THE HOLES MADE BY THE SUGARCANE STALK-BORER, OR THE CRACKING OR DYING FOLLOWING TASSELING.

FUSARIUM POKKAH BOENG

POKKAH BOENG INFECTION SLIGHT:

THE SUGARCANE VARIETY P.O.J. 2878 HAS BEEN REPORTED IN A NUMBER OF OTHER SUGARCANE-PRODUCING COUNTRIES TO BE SUSCEPTIBLE TO THE FUSARIUM POKKAH BOENG DISEASE CAUSED BY F. MONILIFORME. FOR THIS REASON SOME OF THE GROWERS HAVE BEEN RELUCTANT TO PLANT LARGE ACREAGES OF P.O.J. 2878. HOWEVER, IN SPITE OF THE CONSIDERABLE ACREAGES WHICH ARE AT PRESENT PLANTED TO THIS VARIETY, VERY LITTLE POKKAH BOENG WAS OBSERVED THIS YEAR. IT MAY STILL BE TRUE, HOWEVER, THAT UNDER CERTAIN ENVIRONMENTAL CONDITIONS THE DISEASE COULD INCREASE TO DESTRUCTIVE PROPORTIONS HERE.

MECHANICAL POKKAH BOENG IS PRESENT IN THE DRYER REGIONS OF THE ISLAND, OCCASIONALLY BEING FOUND IN P.O.J. 2878.

CHLOROTIC-STREAK

NO DETAILED STUDIES ON CHLOROTIC STREAK HAVE BEEN MADE HERE AS YET:

ALTHOUGH CHLOROTIC STREAK HAS BEEN REPORTED TO OCCUR IN PUERTO RICO, NO DETAILED STUDIES OF THIS DISEASE HAVE BEEN MADE HERE. IN THE PRESENT SURVEY A NUMBER OF INSTANCES HAVE BEEN OBSERVED IN WHICH SYMPTOMS WERE FOUND THAT APPEARED SIMILAR TO THE SYMPTOMS DESCRIBED FOR CHLOROTIC-STREAK DISEASE.

MANGANESE DEFICIENCY

SYMPTOMS RESEMBLE THOSE OF PAHALA BLIGHT IN HAWAII:

IN THE REGION ALONG THE SOUTH COAST THE SUGARCANE IN FAIRLY EXTENSIVE ACREAGES EXHIBITED AN UNUSUAL CHLOROTIC APPEARANCE. THE DISEASED CANE SHOWED DEGREES OF YELLOWING WHICH VARIED FROM A SLIGHT CHLOROSIS TO AN ALMOST COMPLETE WHITENESS OF THE LEAVES. THE CHLOROSIS WAS LIMITED TO THE INTERVEINAL REGIONS OF THE LEAVES, THE VEINS ON THE CONTRARY APPEARING DARK GREEN.

THE SYMPTOMS SHOWN BY THE DISEASED CANE APPEARED TO BE VERY SIMILAR TO THOSE OF CHLOROTIC CANE FOUND IN HAWAII SUFFERING FROM THE DISEASE KNOWN THERE AS PAHALA BLIGHT. THE DISEASE IN HAWAII HAS BEEN SHOWN TO BE CAUSED BY A DEFICIENCY OF AVAILABLE MANGANESE IN THE SOIL. THE SIMILARITY OF THE SYMPTOMS, TOGETHER WITH THE LOW MANGANESE CONTENT AND THE ALKALINE SOIL CONDITION IN THE AFFECTED AREAS STRONGLY SUGGESTS THAT THE CHLOROSIS HERE IS ALSO DUE TO MANGANESE DEFICIENCY.

THE VARIETY COIMBATORE 281 SHOWED RESISTANCE TO THE DISEASE:

THE CANE VARIETIES P.O.J. 2878, MAYAGUEZ 28, B.H. 10(12) ALL SHOWED CHLOROSIS WHEN PLANTED ON AFFECTED SOIL AREAS. IT IS INTERESTING TO NOTE THAT THE VARIETY COIMBATORE 281 WAS GROWN IN THE SAME AFFECTED SOIL AREAS USUALLY WITHOUT SHOWING SEVERE SYMPTOMS OF THE DISEASE.

DISEASES NOT KNOWN TO OCCUR IN PUERTO RICO

EXCLUSION OF FOREIGN DISEASES AND INSECTS IS CHEAPEST CONTROL HERE:

PUERTO RICO HAS BEEN VERY FORTUNATE IN THE PAST IN THAT COMPARATIVELY FEW OF THE SERIOUS SUGARCANE DISEASES HAVE BEEN FOUND HERE. THE DESTRUCTIVENESS OF DISEASES SUCH AS SEREH, FIJI, LEAF SCALD, DOWNY MILDEW, SMUT, AND RUST ARE VERY WELL KNOWN. SOME OF THESE DISEASES CAUSE VERY SEVERE LOSSES IN COUNTRIES WHERE THEY OCCUR, AND THEIR PRESENCE IN PUERTO RICO WOULD PERHAPS CAUSE US TO ABANDON SOME OF OUR BEST VARIETIES, WITH THE COINCIDENT FINANCIAL LOSSES. IT IS LOGICAL, THEREFORE, THAT CANE INTRODUCED FROM OUTSIDE COUNTRIES SHOULD BE GROWN UNDER QUARANTINE UNTIL ITS COMPLETE HEALTHINESS IS ESTABLISHED. ALSO CAREFUL PERIODICAL EXAMINATIONS OF THE CANE FIELDS OF THIS ISLAND WOULD SEEM TO BE ADVISABLE TO PREVENT ANY OF THESE DISEASES FROM GAINING FOOTHOLD.

PLANT QUARANTINE HOUSE IS BEING ERECTED TO HOUSE NEW PLANT INTRODUCTIONS:

EFFORTS TO PREVENT THE INTRODUCTION AND WIDESPREAD ESTABLISHMENT OF NEW DAMAGING CANE DISEASES FROM OTHER COUNTRIES ARE PERHAPS THE MOST EFFECTIVE CONTRIBUTIONS WHICH SPECIALISTS IN SUGARCANE DISEASES CAN MAKE TO THE PUERTO RICAN SUGAR INDUSTRY. WITH THIS AIM IN VIEW THE UNITED STATES DEPARTMENT OF AGRICULTURE IS CONSTRUCTING AT ITS PUERTO RICO EXPERIMENT STATION A QUARANTINE GREENHOUSE TO HOUSE UNDER OBSERVATION INTRODUCTIONS OF NEW ECONOMIC PLANTS TO THE ISLAND. THIS HOUSE WILL BE PROPERLY MOATED, SCREENED AND INSULATED TO PREVENT THE INGRESS OR EGRESS OF INSECTS AND MICROORGANISMS.

THIS PLANT QUARANTINE HOUSE WILL BE AVAILABLE FOR PLANTERS AND OTHERS FOR HOLDING NEWLY INTRODUCED CANE VARIETIES AND OTHER ECONOMIC PLANTS UNDER CLOSE OBSERVATION WHILE BEING PROPAGATED.

SUMMARY

MOSAIC IS THE MOST SEVERE DISEASE OF SUGARCANE IN PUERTO RICO AT PRESENT. IT IS BEING FAIRLY EFFECTIVELY CONTROLLED IN MOST LOCALITIES BY EITHER ROGUEING OR

THE PLANTING OF RESISTANT VARIETIES. SOME EVIDENCE WAS OBTAINED THAT TWO OR MORE STRAINS OF SUGARCANE-MOSAIC VIRUS OCCUR IN PUERTO RICO. THE LEAF-SPOT DISEASES, RING-SPOT, BROWN-STRIPE, AND EYE-SPOT, ARE FOUND IN ALL SECTIONS OF THE ISLAND, BUT BECAUSE MOST VARIETIES GROWN ARE NOT HIGHLY SUSCEPTIBLE, NO SERIOUS LOSSES WERE CAUSED BY THESE DISEASES THIS YEAR. DRY-TOP ROT, FUSARIUM POKKAH BOENG, RED-STRIPE AND RED-ROT WERE OBSERVED PRESENT BUT NOT CAUSING SERIOUS DAMAGE. CONSIDERABLE DAMAGE DUE TO WHAT IS BELIEVED TO BE MANGANESE-DEFICIENCY DISEASE WAS FOUND IN THE SOUTH-COAST REGION. SPECIAL PRECAUTIONS ARE ADVISABLE TO GUARD AGAINST THE CARELESS IMPORTATION OF SUGARCANE SEED PIECES FROM OTHER PARTS OF THE WORLD AND THUS ASSIST IN THE EXCLUSION OF SERIOUS SUGARCANE DISEASES KNOWN IN COUNTRIES OUTSIDE OF PUERTO RICO.

